

Remarks

Claims 1-5, 9-11, 17 and 21-22 are pending. Claims 7, 8 and 12-14 have been withdrawn.

Claims 6, 15, 16 and 18-20 have been canceled. Claims 1, 3 and 4 have been amended.

Claims 23-26 are new.

In addition to a clarifying amendment replacing the term "coil tubes" with the term "channels", claim 1 has been amended to recite the limitations formerly appearing in claim 6, as well as the following additional limitation, which is underlined below:

"A coil-on-tube heat exchanger having a center tube for a first liquid flow, the heat exchanger comprising:

a plurality of channels for a second liquid flow, the plurality of channels helically wrapped in a parallel relationship along the length of the center tube, each of the plurality of channels being in contact with the center tube and extending substantially along the same length of the center tube such that each of the plurality of channels only completes a single wrapping of the center tube, and each of the plurality of channels is arranged such that there is minimum spacing between each of the plurality of channels."

Support for this amendment can be found in paragraph 49 of the application presently on file, which states [emphasis added]:

[0049] In order to limit liquid pressure losses to a modest quantity for different sizes of heat exchangers, the present embodiments of the invention use different numbers of coil tubes. Although presently preferred embodiments use 2 to 6 coil tubes, the invention is not limited to this range. For example, an embodiment of the invention can have a multiplicity of coil tubes that is the maximum number that can be wound around the center tube, so that essentially the heat exchanger has a series of "rings" up the tube, since each coil tube would only complete a single wrapping of the center tube.

As set out by the Applicants in the previous reply dated October 27, 2006, and as set out at paragraph 28 of the application presently on file, the term coil tube includes the term "channel" in the specification. Thus, paragraph 49 also discloses an embodiment in which each of the plurality of channels only completes a single wrapping of the center tube. In view of the fact

that there is explicit support for this amendment, entry of the amendment and examination of the amended claims is respectfully requested.

New Claims 23–26 have been added to claim the preferred use of the present invention, namely the use of the apparatus of the present invention to recover heat from wastewater flows. Support for these amendments can be found in paragraphs 30 and 34 of the specification, which state:

“[0030] The term “liquid” as used herein represents any liquid, such as water, a chemical substance, or any other aqueous solution, liquid or semi liquid substance, such as drain water, waste water or other waste liquid, sludge, grey water, black water or any liquid having solid and/or semi-solid components.

...

[0034] Embodiments of the present invention are preferably used to recover heat from warm flows of wastewater, but the invention is not limited to these applications.”

Accordingly, there is explicit support for new claim 23, which claims the use of the apparatus of amended claim 1 for the exchange of heat from a waste water flow to a second flow. There is also explicit support for new claim 24, which claims the use of the apparatus of claim 1 previously on file for the exchange of heat from a waste water flow to a second flow. In like manner, there is explicit support for claims 25-26, which are substantially identical to claims 21 and 22 respectively, but rewritten as use claims depending from claim 24. In view of this explicit support, entry of the amendment and examination of these new claims is respectfully requested.

Rejection of Claim 1 under 35 USC 112

The Examiner has rejected claim 1 under 35 USC 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner cites the lack of proper antecedent basis “for the coil tubes helically wrapped” in line 3 of claim 1 in support of this rejection. Applicants note that claims 3 and 4 also employ the term “coil tubes”. Accordingly, claims 1, 3 and 4 have been amended to eliminate the inconsistency in the use of the terms “coil tubes” and “channels”. Occurrences of the term “coil tubes” have been replaced with the term “channels”. By this amendment, Applicants complete the change in terminology introduced in the Applicants’ reply

dated October 27, 2006. The Applicants submit that this amendment overcomes the claim rejection under 35 USC 112, since the term “the plurality of channels helically wrapped” has proper antecedent basis. No new material is added by this amendment, support for which can be found at paragraph 28 of the specification currently on file, as set out in the Applicants’ previous reply.

Rejection of Claims 1-5, 9, 11 and 16-22 under 35 USC 102

The Examiner has rejected claims 1-5, 9, 11 and 16-22 under 35 USC 102, in view of Figure 6 of Hughes et al. and its accompanying description in the first full paragraph of column 5.

Applicants here reproduce the first full paragraph of column 5 of the Hughes reference:

“It should be appreciated that while the embodiments discussed above describe one preferred arrangement wherein there is a one-to-one correspondence between the gas tubes 32 and the water tubes 14, in some applications it may be desirable to have one or more of the gas tubes 32 helically wound about each of the water tubes 14. This can be desirable, for example, when a lower pressure drop is desired for the gas flow through the gas tubes 32 and/or an increased amount of gas flow is required through the gas tubes 32 to improve the performance of the water heater/gas cooler. One example of this construction is shown in FIG. 6 wherein there are two of the gas tubes 32 for each of the water tubes 14, with the second set of gas tubes 32 shown by dashed lines for purposes of clarity. In all other respects, the heat exchanger of FIG. 6 is identical to the exchanger of FIG. 1 as described above. It should be understood that such a construction can be applied to any of the above-described embodiments, such as for example, the embodiment shown in FIG. 2, wherein one or more additional gas tubes 32 can be wound about the water tube 14.”

Applicants note that the above-noted passage, cited by the Examiner, does not teach the limitations of amended claim 1 that “each of the plurality of channels only completes a single wrapping of the center tube, and each of the plurality of channels is arranged such that there is minimum spacing between each of the plurality of channels.” Hughes teaches neither of these limitations of amended claim 1, and furthermore, Hughes cannot teach such limitations,

since the maximum pitch he gives is 2.0 inches for a gas tube (32) having a maximum inner diameter of .10 inches (at column 4, line 55). Notwithstanding the fact that a two inch long pipe is of no use (and therefore clearly not disclosed by Hughes), the only way that Hughes could teach the limitation of minimum spacing, in the case of a two inch long inner pipe, is if there were twenty gas tubes (32) each having an inner diameter of 0.2 inches. This result is clearly not taught by Hughes, since its usefulness as a counter-flow heat exchanger would be nil except in the case where the inner tube (14) was carrying an extremely viscous fluid like bitumen, which is not taught by Hughes. At the opposite extreme, if Hughes were taken as disclosing a pipe 0.2 inches long, with two helical gas tube (32) coils each having a pitch of 0.2 inches and an inner diameter of 0.1 inches, the tubes would not only have to have walls of zero thickness, but the inner tube would be little more than a bushing or washer, again a result that Hughes cannot be reasonably interpreted as teaching.

Therefore, in view of the fact that Hughes does not and cannot teach or suggest the limitations of amended claim 1, the Applicants respectfully request that the rejection of claim 1 under 35 USC 102 be withdrawn. Since the Examiner's rejections of claims 2-5, 9, 11 and 16-22, which are all dependent on claim 1, are based on the Examiner's rejection of claim 1, the Applicants respectfully request that the rejections of these claims be withdrawn on the same grounds.

Rejections of Claims 6, 10 and 15 under 35 USC 103(a)

The Examiner has rejected claim 15 as obvious in view of Hughes et al. Claim 15 has been canceled, and the rejection of claim 15 is therefore now moot.

The Examiner has rejected claims 6 and 10 as obvious in view of Hughes, having regard to Janssen. Applicants have canceled claim 6, and incorporated its limitations into claim 1, which has also been amended to include the limitation that "each of the plurality of channels only completes a single wrapping of the center tube". Claim 10 also includes this limitation, since it depends directly from claim 1. While Hughes teaches a gas based heat exchanger and Janssen teaches a liquid to liquid heat exchanger, these references cannot be combined to result in the invention described in the amended claims. For at least the reasons provided above, Hughes does not teach or suggest the newly added limitations, and Janssen does not provide what Hughes lacks. Applicants submit that in view of this amendment, neither Janssen nor Hughes, either alone or in combination teach all of the limitations of claims 1 or 10, and

respectfully request that the Examiner's rejections of these claims under 35 USC 103(a) be withdrawn.

New claims 23-26

New claims 23-26 claim the use of the heat exchanger of the present invention for the specific purpose of exchanging heat from waste water flows to a second liquid flow. As is well known to those skilled in the art, waste water flows are low pressure flows, typically fed by gravity. Waste water transport systems are not designed to use the entire capacity of the tube in which they flow, because the flow rate is insufficient for the entire cross-section of the tube to be immersed. Consequently, the average distance between flow elements and the inner surface of the tube is lower or shorter, which results in better heat transfer. Furthermore, as is well known to those of skill in the art, the velocity profile of a fluid flow is directly related to the distance of the flow elements from the nearest surface (where the velocity is theoretically zero). As a result, because the average distance between flow elements and the inner surface of the tube is shorter, the flow of waste water through a tube tends to be much slower than would be the case in a higher-pressure flow where the entire cross section of the tube is immersed. Because its velocity profile is slower, the waste water takes slightly longer to flow through the heat exchanger, and it has more time to transfer heat to the second fluid.

Because the average distance between the waste water flow elements and the second fluid is smaller, and because the heat transfer characteristics of flows that do not immerse the entire cross section of the tube are better, the net result is a far more efficient heat exchanger than would be the case in an ordinary liquid to liquid, or liquid to gas heat exchanger. Claims 23-26 all include the limitation of using the coil on tube heat exchanger of the present invention for exchanging heat from the waste water flow to the second liquid flow. Thus, the liquid to gas heat exchanger of Hughes cannot teach or suggest the use of claims 23-26, since Hughes et al. does not teach or suggest the use of its heat exchanger for the exchange of heat from waste water to a second liquid flow. Furthermore, Janssen does not teach the limitation of "a plurality of channels helically wrapped in a parallel relationship along the length of the center tube". The Applicant submits that neither Hughes nor Janssen would be used in a wastewater application because the flow in the inner tube is separated, which can result in fouling issues.

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For at least the reasons provided above, Hughes does not teach or suggest the limitations of newly added claims 23-26, Janssen does not teach or suggest all of the limitations of newly added claims 23-26, Janssen does not provide what Hughes lacks, and Hughes does not provide what Janssen lacks. Therefore, newly added claims 23-26 are patentably distinct over both Hughes and Janssen, either alone or in combination.

It is submitted that this application is now in condition for allowance. Early and favourable consideration is respectfully requested.

The Commissioner is hereby authorized to debit \$60.00 from Deposit Account No. 501593, in the name of Borden Ladner Gervais LLP.

The Commissioner is hereby authorized to charge any additional fees, and credit any over payments to Deposit Account No. 501593, in the name of Borden Ladner Gervais LLP.

Respectfully submitted,

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